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ATMOSPHERIC PROCESSES FROM SPACE PLATFORMS  
Final Report, 10 Apr. 1980 - 31 Dec. 1983  
(Universities Space Research Association)  
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## FINAL REPORT

### RESEARCH STUDY:

STUDIES IN ATMOSPHERIC PROCESSES FROM SPACE PLATFORMS

CONTRACT NAS 8-33730

CONTRACT PERIOD: APRIL 10, 1980 - DECEMBER 31, 1983

### PREPARED FOR:

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## FINAL REPORT

### NARRATIVE REPORT COVERING THE RESEARCH STUDY: STUDIES IN ATMOSPHERIC PROCESSES FROM SPACE PLATFORMS

Contract NAS8-33730

April 10, 1980 - December 31, 1983.

This document is the Final Report for the Contract NAS8-33730, "Research Study: Studies in Atmospheric Processes from Space Platforms." The start of the contract was April 10, 1980; the contract, originally with a one-year time span, was extended a number of times, and finally terminated December 31, 1983. Throughout the lifetime of the contract, the cognizant official at NASA/MSFC was Dr. William Vaughan.

One of the primary objectives of the Space Platforms contract in its earliest period was general support for the USRA office in Boulder, Colorado: the USRA Atmospheric Processes Program. Besides this general support, a number of special projects were undertaken and completed. The first was an exploratory study for "LARS," a suggested Low Altitude Research Satellite system to complement UARS, the Upper Atmosphere Research Satellite System. Mr. John Masterson, a research meteorologist recently retired from NCAR, assisted in the preparation of the report "Exploratory Investigation of the Need for and Feasibility of a Lower Atmosphere Research Satellite (LARS) Program" which was submitted to NASA/MSFC October 14, 1980. This report was the outcome of a series of discussions with experts in the field including Robert B. Fleagle, University of Washington; Verner E. Suomi, University of Wisconsin; Cecil E. Leith, Jr., NCAR; Andrew P. Ingersoll, Cal Tech; Charles L. Hosler, Jr., Penn State; Paul J. Crutzen, NCAR; and others. It

considered the potential of and need for a dedicated satellite system to observe phenomena in the lower atmosphere at time scales from short-term to climate-scale, and discussed a candidate experiment set, types of missions, orbit considerations, and other preliminary conclusions relating to a such a system.

The next project undertaken was support for Dr. T. Pepin, University of Wyoming, who chaired a panel to discuss the status of knowledge of atmospheric aerosols as applied to the proposed satellite-borne Doppler lidar wind monitoring system. (Dr. Leith and others during the LARS study had stressed the need for accurate wind data and the desirability of a world-wide satellite system to monitor tropospheric winds, if such a system were feasible.) A vital link in the planning for a satellite-borne wind monitoring system is the lidar itself. During the first quarter of 1981, USRA sponsored a panel chaired by Dr. Aram Mooradian of MIT Lincoln Labs to examine the status of high energy CO<sub>2</sub> satellite-borne laser technology. A series of meetings were held. For high-power lasers, a major question is how to certify that a proposed laser system will have the required lifetime in orbit.

One of the most intriguing and controversial questions in all of meteorology is whether there is a direct connection between solar variability and weather. Although a considerable amount of evidence has appeared in the literature suggesting both short-term effects and long-term climate effects, the subject remains controversial, with disbelief by the majority of atmospheric scientists. However, if such an effect could be

verified, and particularly, if a physical mechanism could be identified that was subject to direct study, it would have important consequences for all of geoscience. Besides its fundamental interest, there is always the possibility that such a finding would enable forecasters to remove one more uncertainty from forecasts, that now for lack of knowledge is thought of as a consequence of turbulence or poor input data. In 1981, USRA began to fund research studies by Maj. Bruce Springer, who was working in collaboration with Dr. Robert Orr Roberts on a new promising physical mechanism that suggested a coupling between temperature changes in the thermosphere and the lower atmosphere through changes in the refractive index to upward propagating planetary waves. Springer continued working on these ideas for several years with a small grant-type support from USRA to help defray expenses such as computer time. Another small sun-weather project was carried out by H. Prescott Sleeper, who examined the statistics of worldwide effects of wintertime solar flare activity.

In January, 1982, M. H. Davis assisted Dr. Thomas Vonder Haar of CSU with the 62nd Annual Meeting of the American Meteorological Society (AMS), 12th Conference on Severe Local Storms, held in San Antonio, Texas. USRA assembled and edited the Proceedings on the Conception, Growth, Accomplishments, and Future of Meteorological Satellites. Speakers were T. Vonder Haar, Morris Tepper, William W. Kellogg, David S. Johnson, Brig. Gen Albert J. Kaehn, Eugene W. Bierly, and David Atlas. The Chairman was Dr. William Vaughan.

In mid-1982, Mr. Lewis Allison began activities as Research

NASA CR 2257

Specialist assisting in a variety of tasks related to the NASA Global Weather Research Program in Washington, D.C. USRA also sponsored other scientists to participate in scientific meetings dealing with atmospheric processes and with atmospheric electricity modeling. In November, 1982, an article was submitted to the Bulletin of the AMS describing and advocating the development of a Lightning Mapper Sensor Satellite System.

During the first part of 1983, the principal activity under this contract was the organization in February of a workshop on a proposed charged particle technique to disperse warm fog. This workshop was held at NCAR in Boulder, Colorado and brought together a distinguished panel of experts in atmospheric electricity and cloud physics. A detailed report was prepared by USRA that summarized the findings of the panel and outlined a possible program for future research and development. NASA CR-170802

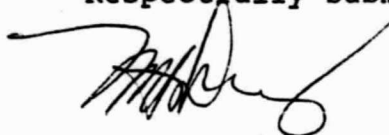
The final period of this contract, the last half-year of 1983, saw support for flow studies by several research specialists, in support of space vehicle planning efforts, together with studies by Mr. David Bowdle, a USRA Visiting Scientist at NASA/MSFC dealing with aerosol studies, again related to the proposed satellite-borne wind-monitoring system.

A new contract, NAS8-35530, which began in September, 1983, continued the work begun under NAS8-33730. The final time-period for the later contract, extended on a no-cost basis until year-end, 1983, allowed USRA to wind up contract work in an orderly manner.

USRA wishes to thank the National Aeronautics and Space

Administration, and particularly Dr. William Vaughan, the contract monitor, for the opportunity of participating in so many interesting and challenging programs under the sponsorship of this contract.

Respectfully submitted,



M. H. Davis, Ph.D.

Principal Investigator

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